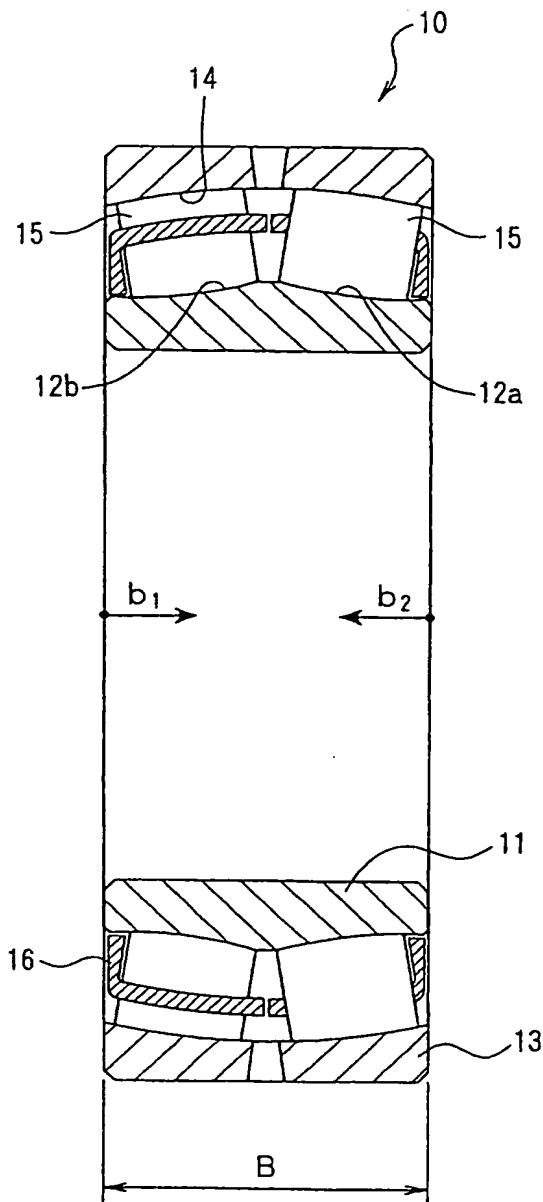


図1 Fig. 1



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図2 Fig. 2

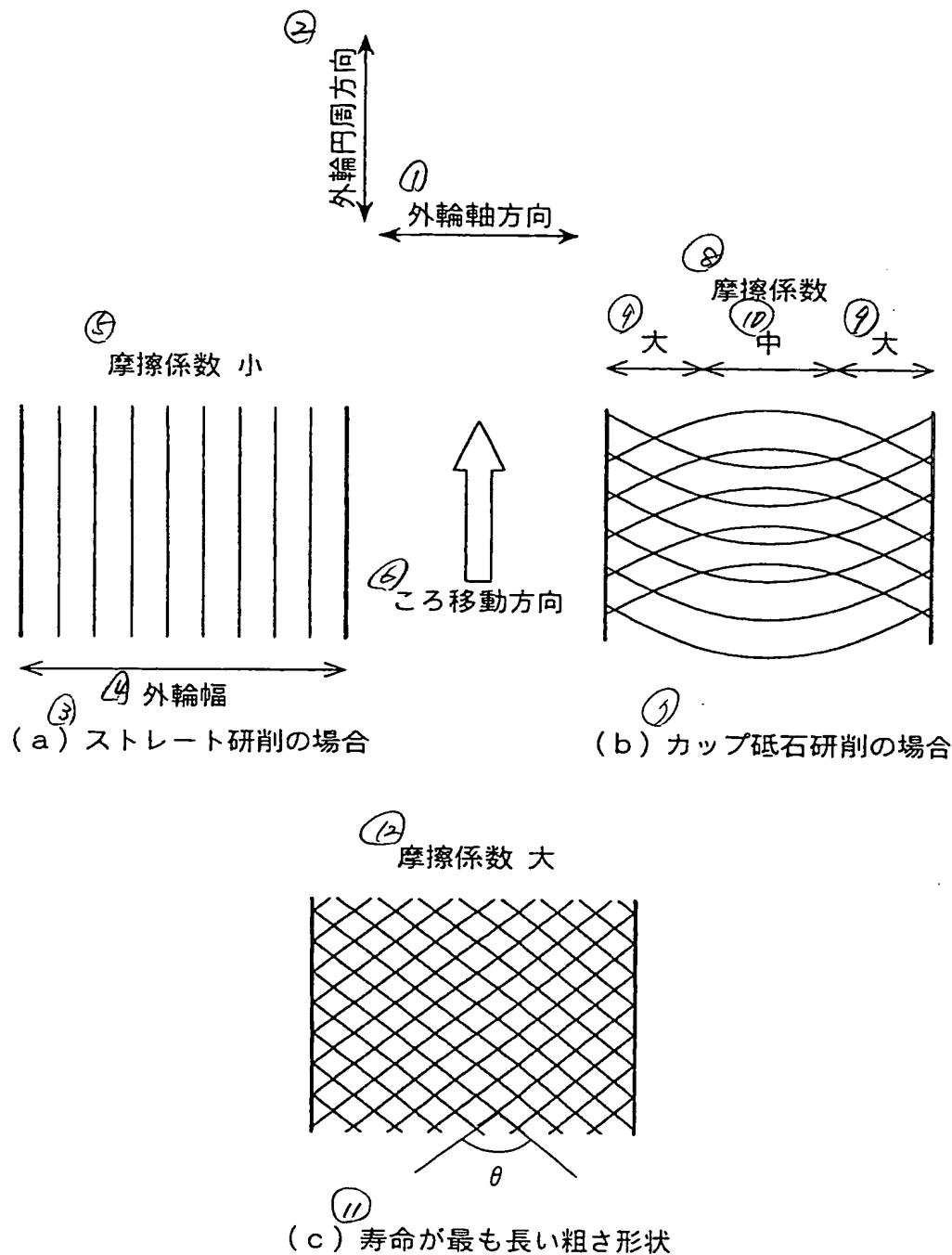


図3 Fig. 3

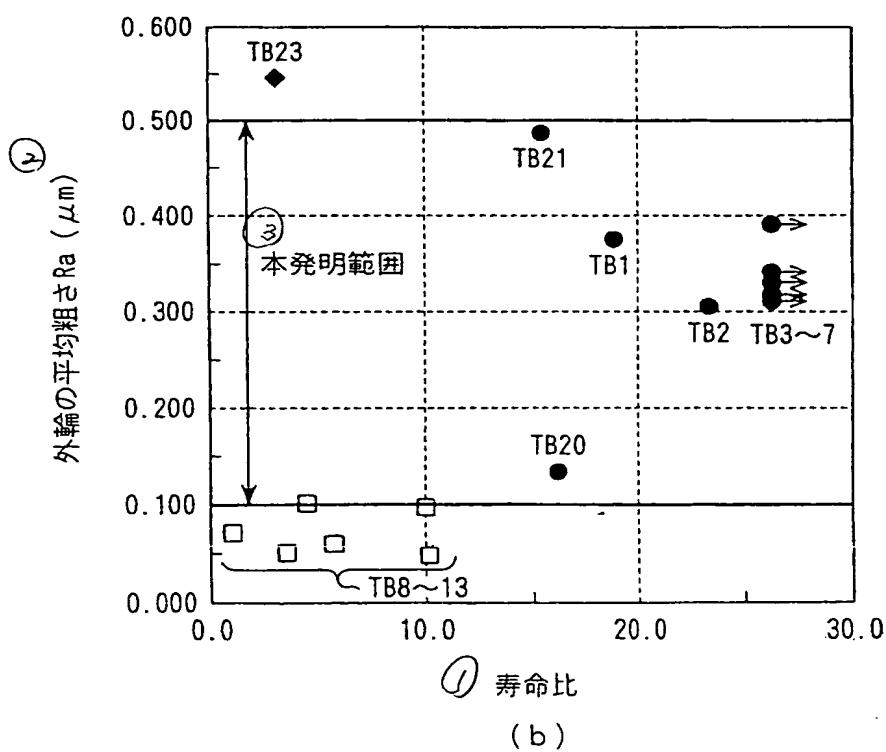
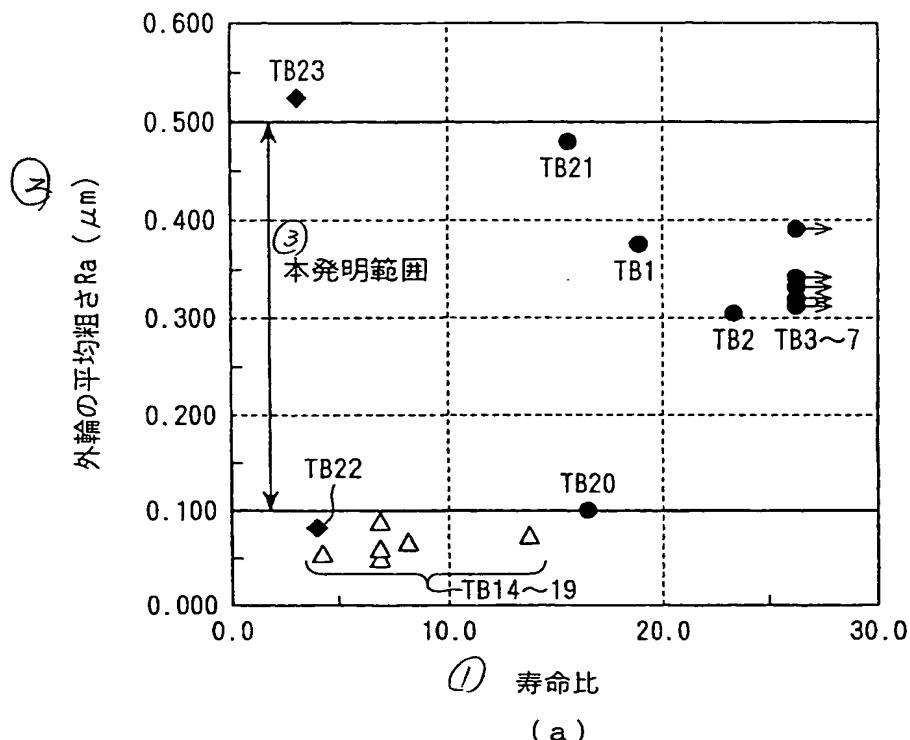


図4 Fig. 4

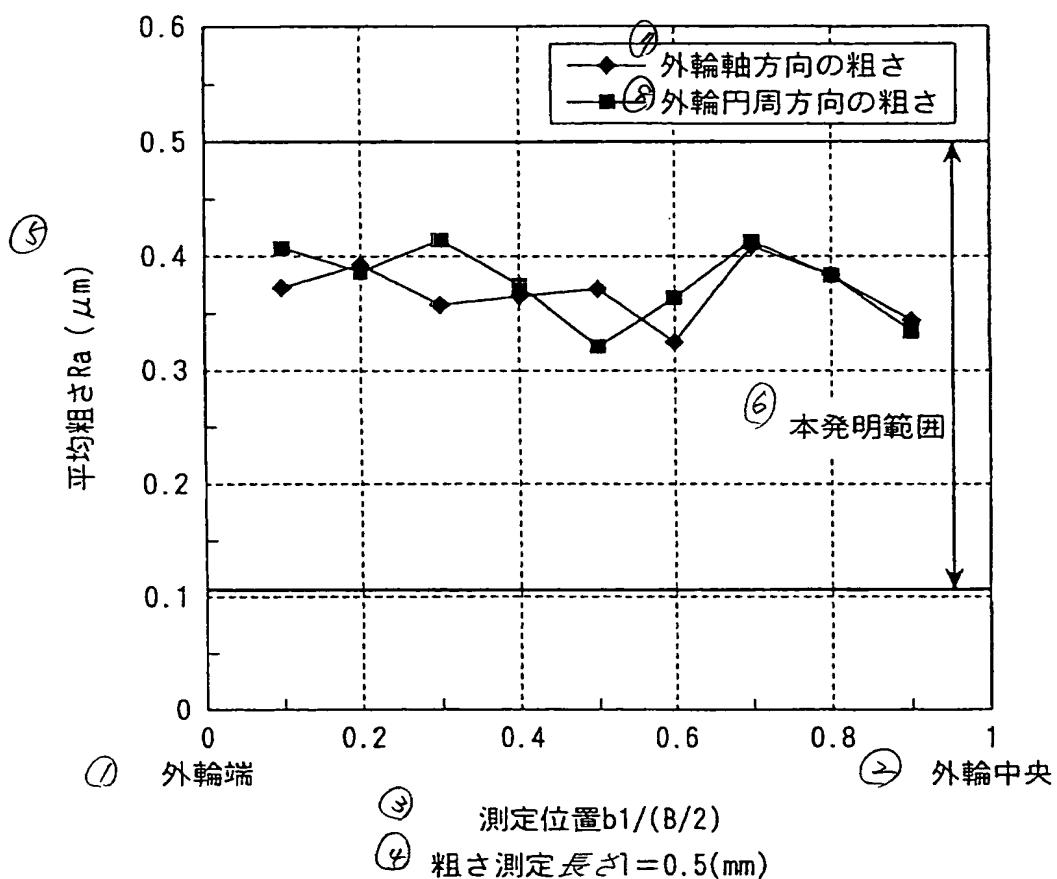


図5 Fig.5

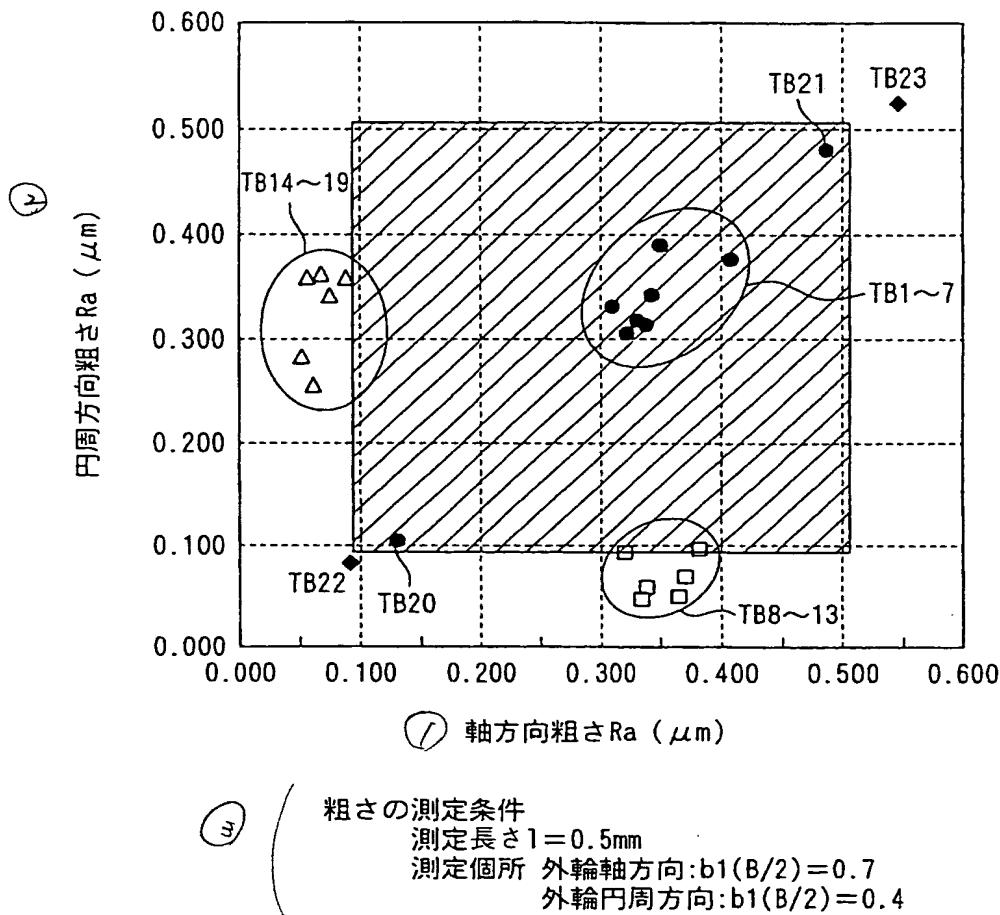


図6

$$S = \frac{1}{n} \sum_{i=1}^n S_i$$

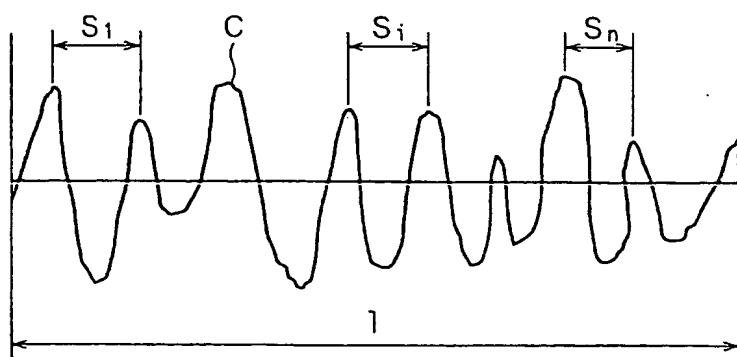


図7 Fig. 7

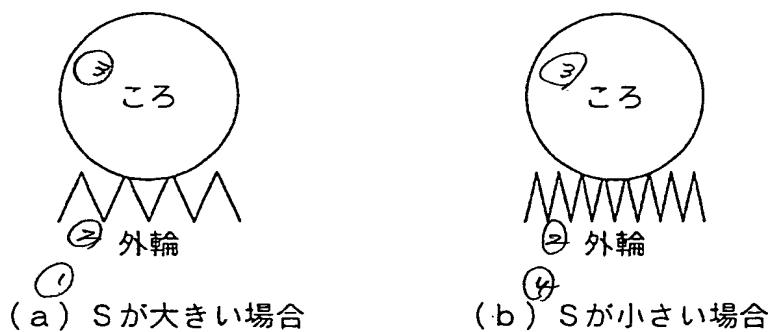


図8 Fig. 8

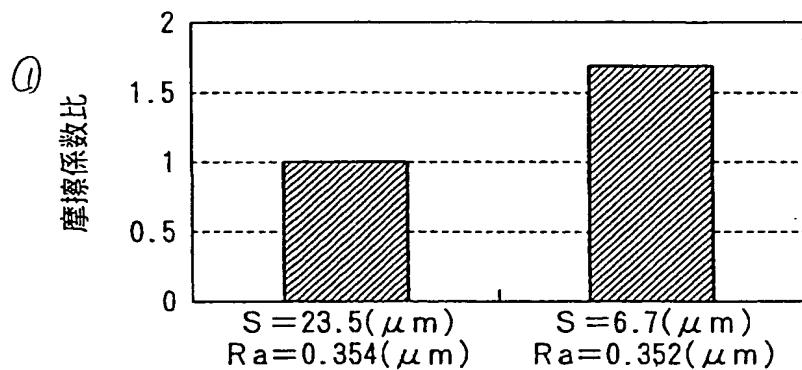
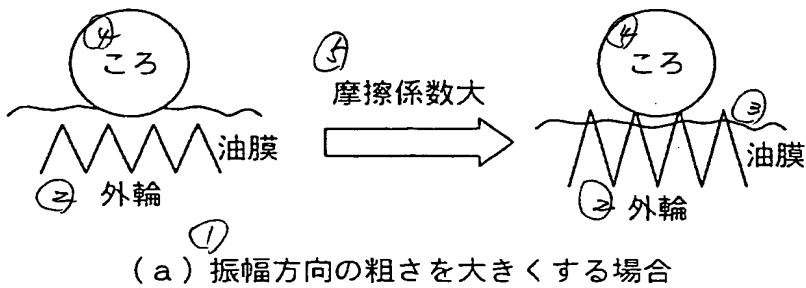
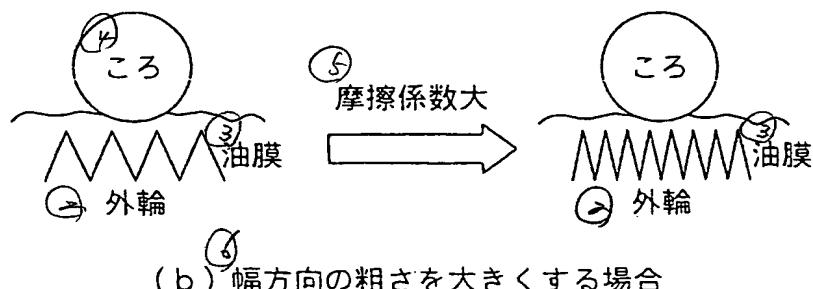


図9 Fig. 9

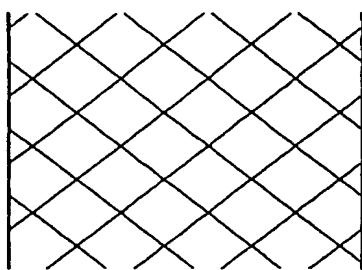


(a) 振幅方向の粗さを大きくする場合

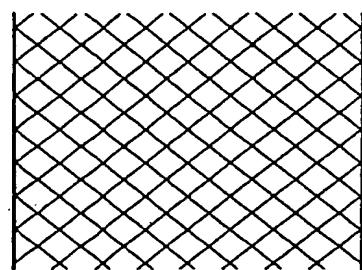


(b) 幅方向の粗さを大きくする場合

図10 Fig. 10



(a) S 大(摩擦係数小)



(b) S 小(摩擦係数大)

図11 Fig. 11

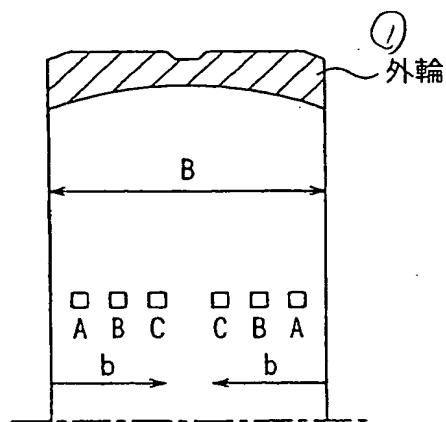


図12 Fig. 12

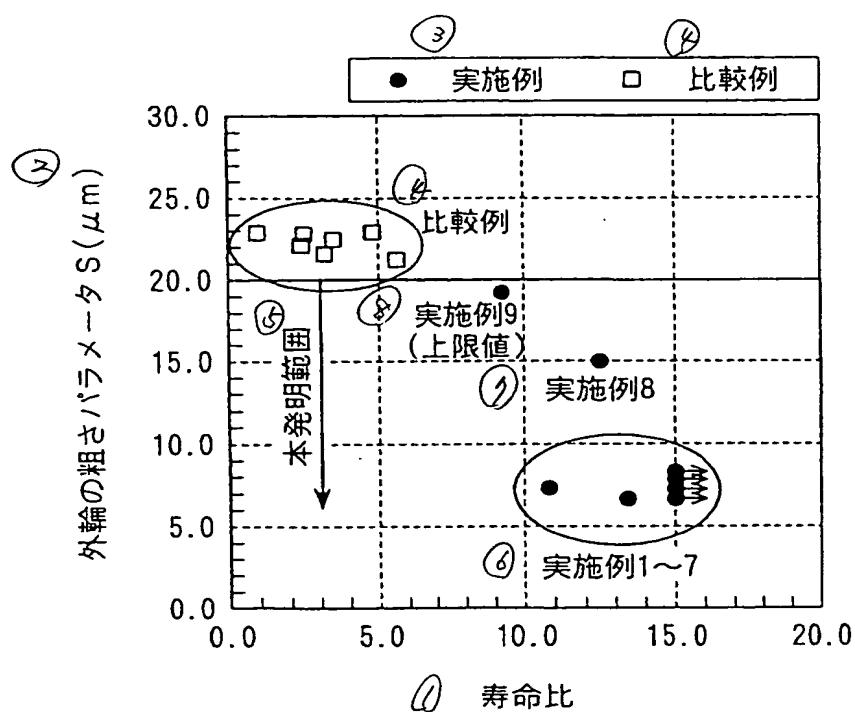


図13 Fig. 13

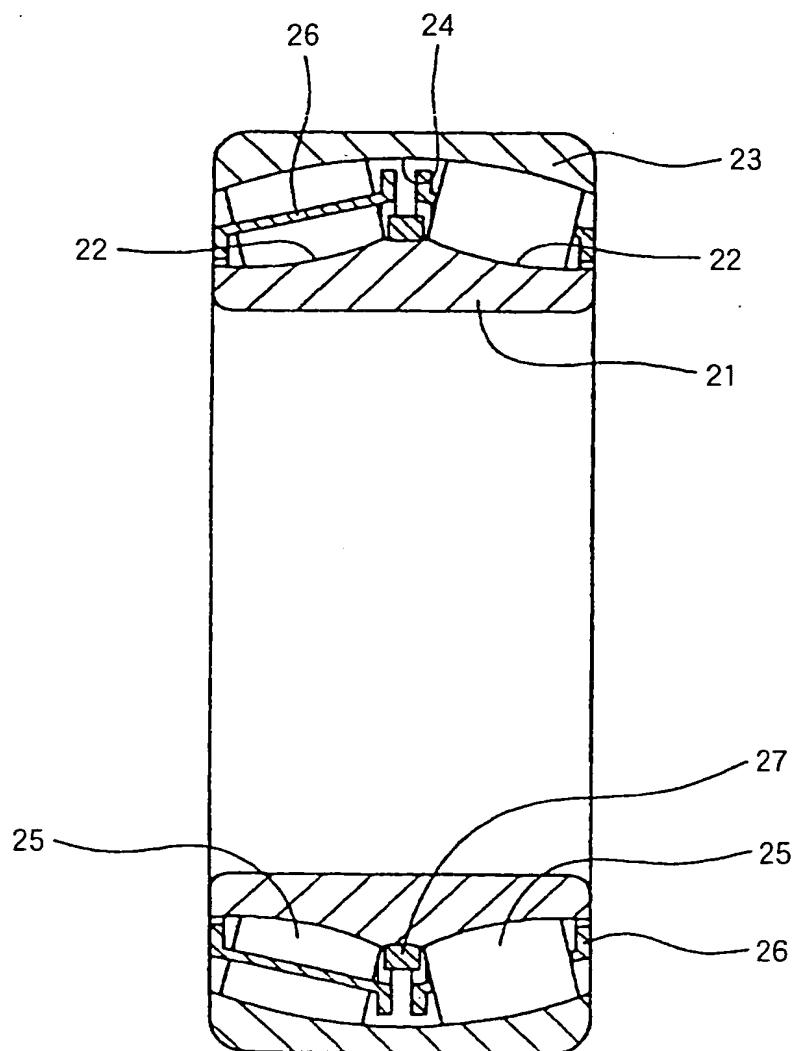


図14 Fig. 14

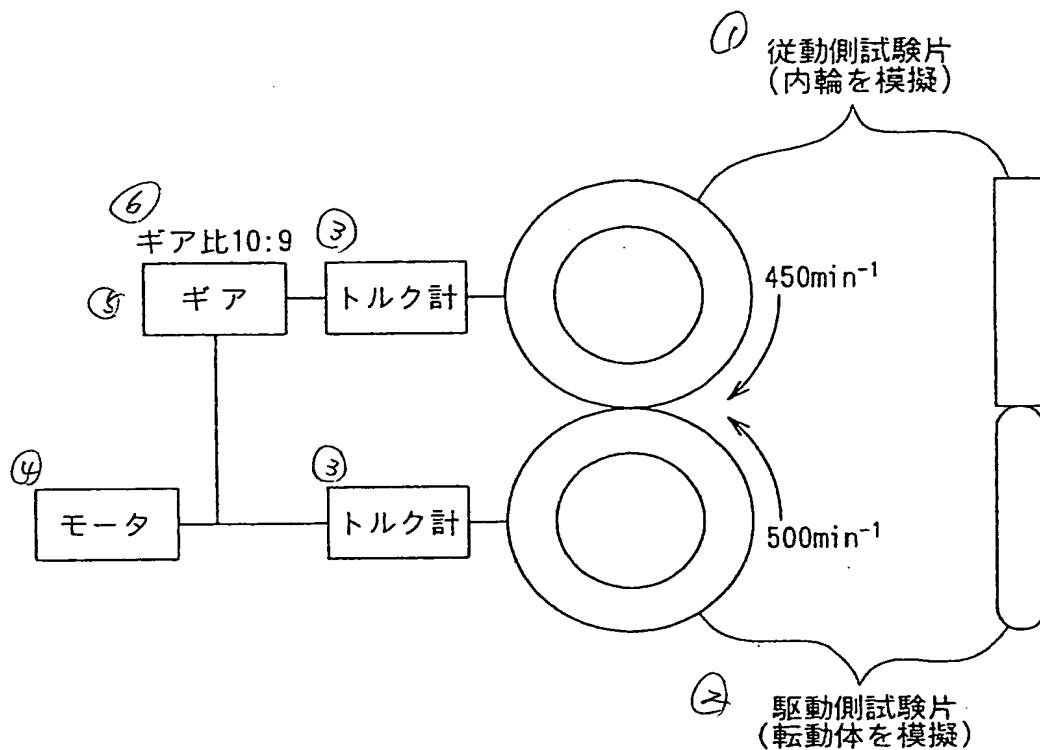


図15 Fig. 15

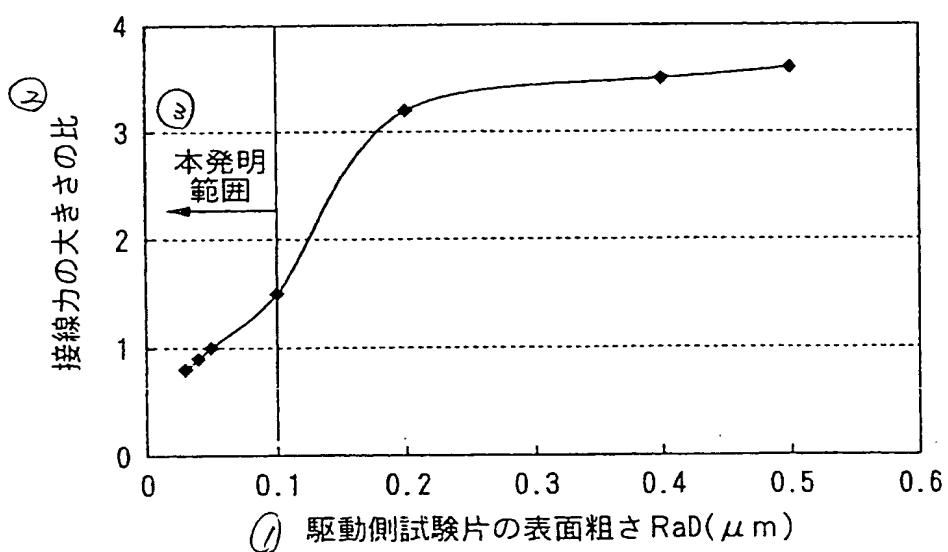


図16 Fig. 16

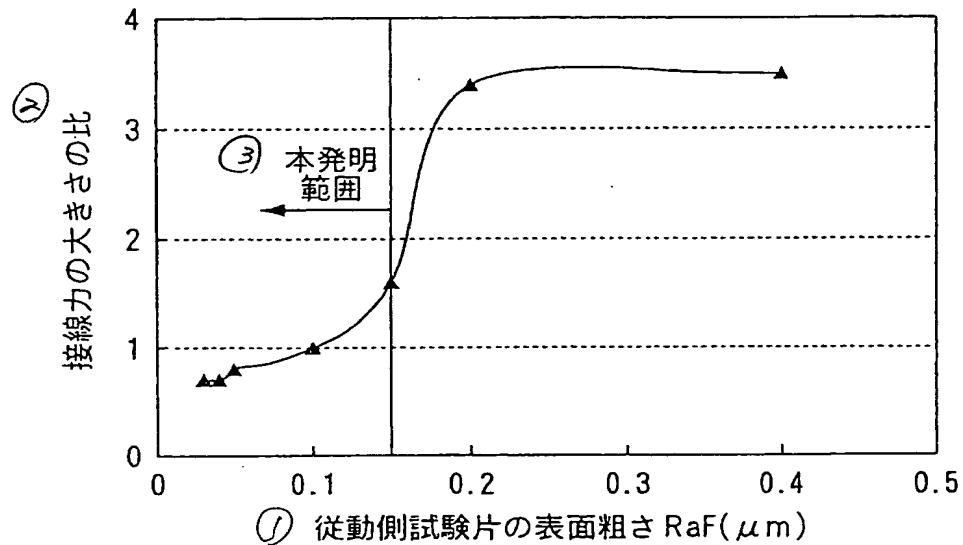


図17 Fig. 17

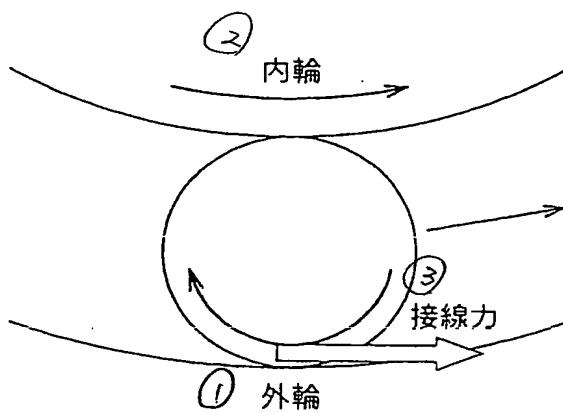


図18 Fig. 18

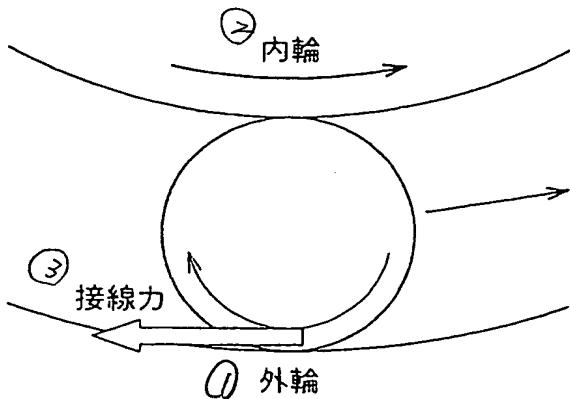


図19 Fig. 19

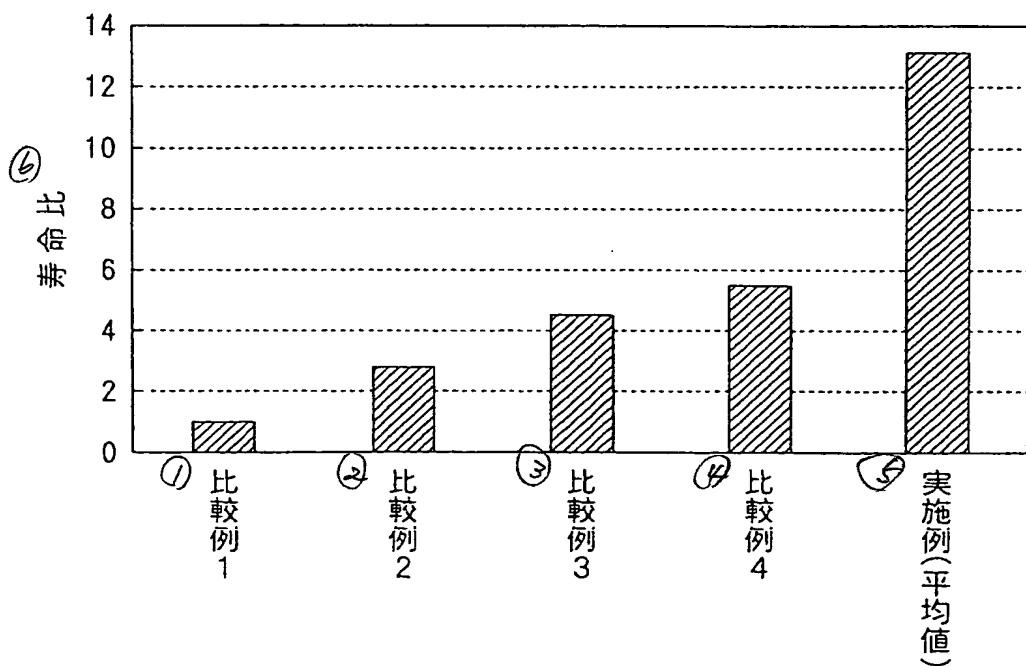


図20 Fig. 20

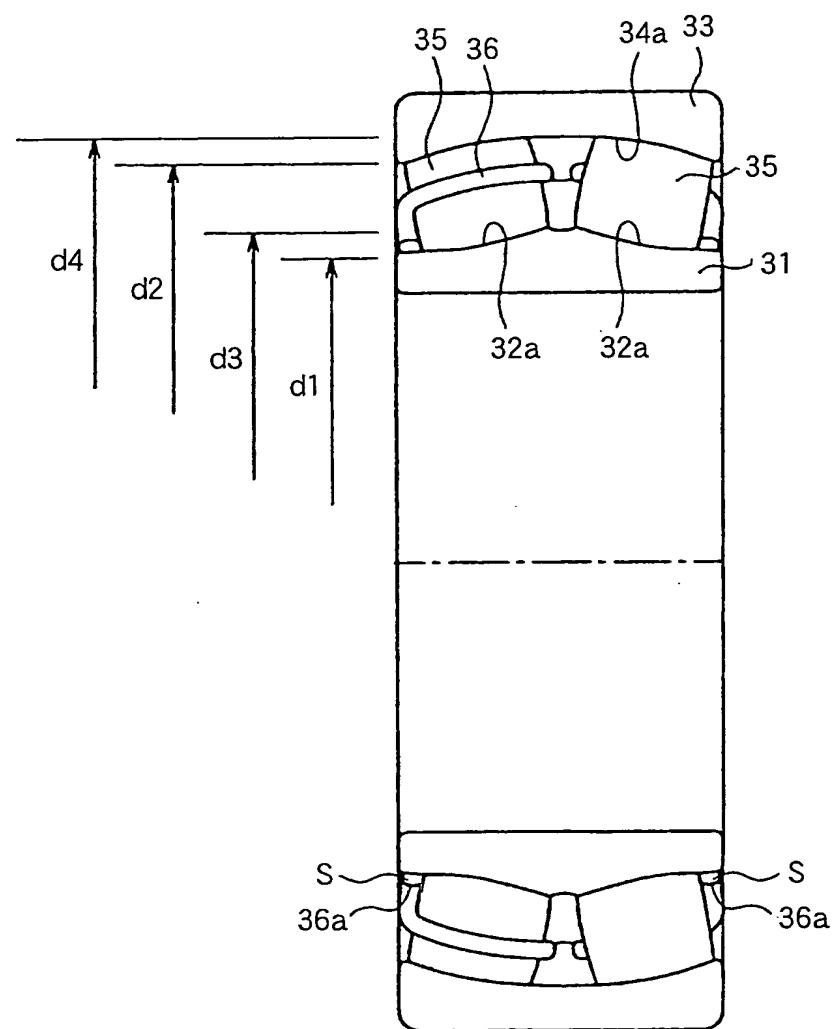


図21 Fig. 21

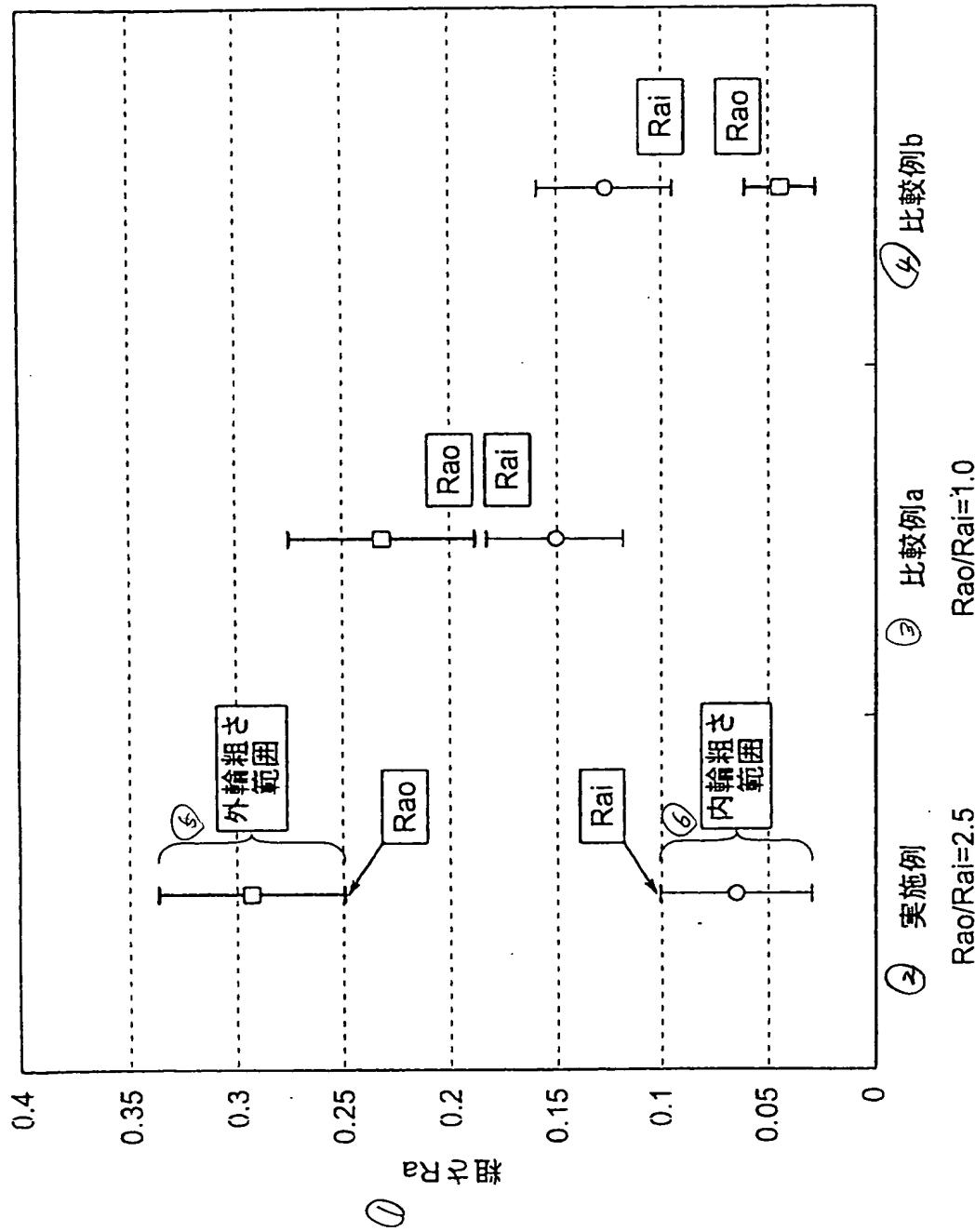


図22 Fig. 22

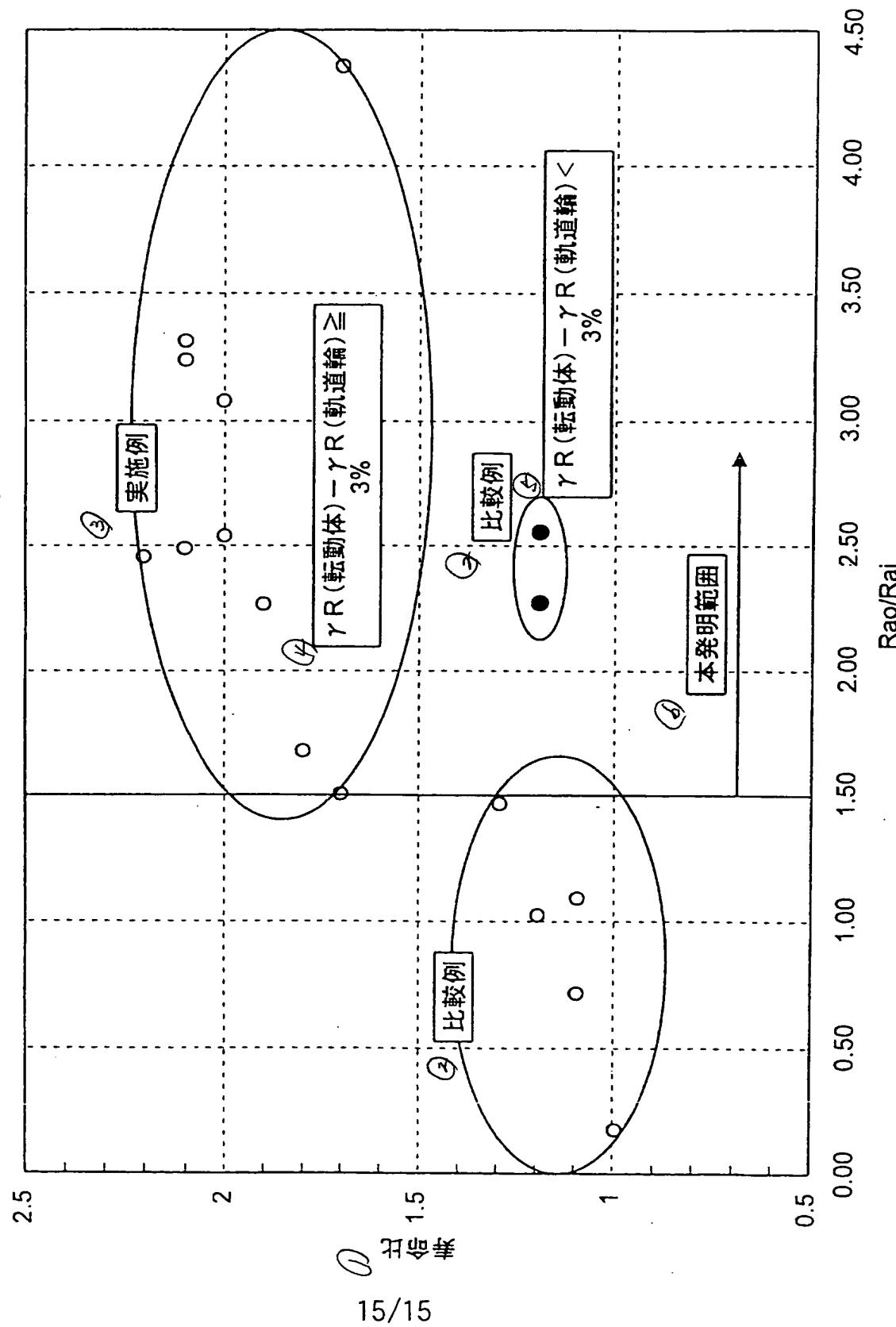


FIG.2:

- (1) outer ring axial direction
- (2) outer ring circumferential direction
- (3) (a) the case of straight grinding
- (4) outer ring width
- (5) coefficient of friction small
- (6) roller moving direction
- (7) (b) the case of cup-grindstone grinding
- (8) coefficient of friction
- (9) large
- (10) middle
- (11) (c) roughness pattern by which the longest lifetime is given
- (12) coefficient of friction large

FIG.3:

- (1) lifetime ratio
- (2) outer ring average roughness R_a (μm)
- (3) range of the present invention

FIG.4:

- (1) end of the outer ring
- (2) center of the outer ring
- (3) measured position $b_1/(B/2)$
- (4) roughness measured length $l=0.5$ (mm)
- (5) average roughness R_a (μm)
- (6) range of the present invention
- (7) roughness in the outer ring axial direction
- (8) roughness in the outer ring circumferential direction

FIG.5:

- (1) axial direction roughness R_a (μm)

(2) circumferential direction roughness R_a (μm)

(3) roughness measuring conditions

measured length $l=0.5$ mm

measured locations

outer ring axial direction: $b_1(B/2)=0.7$

outer ring circumferential direction: $b_1(B/2)=0.4$

FIG.7:

(1) (a) the case where S is large

(2) outer ring

(3) roller

(4) (b) the case where S is small

FIG.8:

(1) coefficient of friction ratio

FIG.9:

(1) (a) the case where the roughness in the amplitude direction is increased

(2) outer ring

(3) oil film

(4) roller

(5) the coefficient of friction is increased

(6) (b) the case where the roughness in the width direction is increased

FIG.10:

(1) (a) S large (coefficient of friction small)

(2) (b) S small (coefficient of friction large)

FIG.11:

(1) outer ring

FIG.12:

- (1) lifetime ratio
- (2) outer ring roughness parameter S (μm)
- (3) embodiment
- (4) comparative example
- (5) range of the present invention
- (6) Example 1 to 7
- (7) Examples 8
- (8) Example 9 (upper limit)

FIG.14:

- (1) driven-side test piece (simulation of the inner ring)
- (2) driving-side test piece (simulation of the rolling element)
- (3) torque meter
- (4) motor
- (5) gear
- (6) gear ratio 10:9

FIG.15:

- (1) surface roughness RaD (μm) of the driving-side test piece
- (2) magnitude ratio of tangential forces
- (3) range of the present invention

FIG.16:

- (1) surface roughness RaF (μm) of the driven-side test piece
- (2) magnitude ratio of tangential forces
- (3) range of the present invention

FIGS.17, 18:

- (1) outer ring
- (2) inner ring
- (3) tangential force

FIG.19:

- (1) Comparative Example 1
- (2) Comparative Example 2
- (3) Comparative Example 3
- (4) Comparative Example 4
- (5) Embodiment (average value)
- (6) lifetime ratio

FIG.21:

- (1) roughness Ra
- (2) Embodiment Rao/Rai=2.5
- (3) Comparative Example a Rao/Rai=1.0
- (4) Comparative Example b
- (5) outer ring roughness range
- (6) inner ring roughness range

FIG.22:

- (1) lifetime ratio
- (2) Comparative Example
- (3) Embodiment
- (4) $\gamma R(\text{rolling element}) - \gamma R(\text{raceway ring}) \geq 3\%$
- (5) $\gamma R(\text{rolling element}) - \gamma R(\text{raceway ring}) < 3\%$
- (6) range of the present invention

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